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ABSTRACT

Human infants are sensitive from birth to some intrinsic properties of objects; they are also sensitive to position. During the first weeks of life, pertinent dimensions of differentiation between objects are relative to global properties of the entire object or pattern. Position is defined by the direction of a displacement: the trajectory followed by a mobile object, the orientation of the infant's body, or the direction of a movement like head turning or arm thrusting. Movements are differentiated by their direction relative to the infant. During this early period, regularities can be observed between changes in the environment and modifications in the infant's behavior. However, differentiation and recognition measured by a specific index (fixation time, for example) are relative to changes or non-changes in global sensorimotor exchanges between the infant and his or her environment. It is only when these sensorimotor exchanges become dissociated in their components that the infant will progressively become able to identify and differentiate perceiving and acting, position and intrinsic properties, etc. As a component is isolated and functions independently from others, it can enter in relation with others to form structured sensorimotor or intermodal coordinations. This conclusion is not original; other researchers work according to the same assumptions within their own theoretical frames. (Author/RH)

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EVENT PERCEPTION AND PATTERN PERCEPTION IN EARLY INFANCY

Contribution to the Symposium : Development of event perception.

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Objects are specified by intrinsic properties (shape, color, size, texture, arrangement etc.) and by their position, relative to other parts of the environment or/and to the observer. Intrinsic properties remain invariant, at least for the duration of an experimental session, whereas positions vary.

A very large amount of studies has been devoted to the capacities of infants to discriminate between objects (2 or 3 dimensional) and a repertory of relevant dimensions of differentiation has been established for newborns and older infants.

Recent studies have also demonstrated that 2-week-old infants

are already able to respond to and discriminate between trajectories of mobile objects.

The renewal of interest for the problem of object permanence and especially the so-called stage IV place error has raised the question of the capacity of 6-month-olds to perceive, to remember the position of a stationary object and to differentiate it from another position occupied later by the same object. The presence of audio-visual-coordination in newborns has been interpreted by some authors (Alegria and Noirot, 1978) as a sign of a capacity to locate a sound in space. But I do not know of any systematic study (which does not mean that there are none) of discrimination between places by infants under 4 months of age. It even seems that, in pattern perception studies, authors assume that infants do not pay attention to the targets' position but respond only to their intrinsic properties.

The bulk of data already published on pattern perception demonstrates that infants are able from birth to differentiate between visual targets and to recognize visually some of their intrinsic properties. But these data do not prove that infants under 3-4 months of age are unable to perceive the position of targets nor they discard it in favor of their intrinsic properties.

I shall even try to demonstrate that, in very young infants, whenever a large motor response accompanies the visual response to a stationary target, changes in this visual response can be produced by a change in target position as

well as by a change of pattern.

Let us first analyze the characteristics of the experimental paradigms and procedures used with newborns and very young infants in pattern perception studies.

Paired comparison technique utilizes innate visual preferences for some values on relevant dimension of differentiation. Two different targets are presented simultaneously side by side and each target appears equally often to the right and to the left of a central peep-hole. Two targets are considered as differentiated when one receives systematically more visual attention than the other.

Infants who look always at the left target (or at the right one) are considered as failing to execute the task, and their frequency among the youngest subjects (59 % in a study with 1-month-olds) is a painful problem. The origin of such stereotypy in response is not clear, but researchers have been essentially interested in neutralizing this "position factor". The increasing popularity of the habituation paradigm is largely due, at least with very young infants, to this reason. With this other paradigm, the experimenter presents only one target at a time, always in the same place, using the preference for a novel, relatively to a familiarized target as a measure of differentiation.

In all experiments performed with newborns and infants of a few weeks of age, great care has been taken to allow the subjects to obtain all the necessary information by looking

without moving head or body. When two targets are presented they are relatively close to each other : no more than 20° of visual angle separate the two inner borders of the targets. The dimensions of differentiation to which infants of these ages are sensitive are global ones, like : pattern versus non-pattern, curved vs straight contour, flat vs 3 dimensional, numerosity, size, intensity, mobile vs stationary, etc. Thus even looking at a limited area of the target provides relevant information about the concerned dimension. In order to make the infant happy and comfortable and to compensate for the poor axial tonus of very young subjects, some authors use an adjustable chair which maintains the positioning of the head (Miranda, 1970). Others use the habituation paradigm and place the infants on the side, in their own crib, and insert against the side of the crib a large target which occupies most of the infant's effective visual field (Friedman, 1972). It is obvious that the infant is strongly encouraged to limit his activity to oculo-motricity.

In order to test directly the hypothesis that a change in the position of a stationary target can produce a change in the visual response of infants younger than 3 months, M.-G. Pêcheux and I made the following study.

An attractive object (a multicolored striped ball) was presented repeatedly on the same side of the infants (the right side for half of them, the left side for the others) until the subject had reached a criterion of habituation or

after 12 to 15 trials. Then the same ball was presented on the other side. Thus the intrinsic properties of the ball remained invariant, only its position was changed in the test trials. The distance between the initial fixation point, on midline, and the ball, was 40° of visual angle so that infants had to make a substantial head turn to look at the stimulus, in each trial. Initially we had 3 age groups, 40 to 60 days, 61 to 80 and 85 to 121 days. The 2 younger groups gave the same kind of performance and their data were pooled. The results are clear. Over 3 months of age, the infants did not modify their fixation time on the test trials. They behaved as if the ball remained the same when its position was changed. Infants under 3 months displayed a large reaction on the test trials. These who had reached the criterion of habituation increased significantly their fixation time when the ball changed side, those who had not reached the criterion decreased significantly their fixation time. But both sub-groups behaved as if the ball had become a new stimulus, when presented in a new position.

From this rapide survey of some studies on visual differentiation it appears that :

1) When the experimental situation does not induce a large motor response, like head-turning, the visual response to different targets depends from their intrinsic properties and the relative position of the targets is not taken into account. This seems true from birth.

2) When the experimental situation is such that important

motor responses are necessary to allow vision of the stimulus, the visual responses can be influenced by changes in position as well as by changes in the intrinsic properties of the stimulus object. Only infants under 3 months of age demonstrate this influence of position, older infants (4 month olds) respond to the invariant properties of a target, rather than to its position.

3) It follows that, in very young infants, a visual response, like duration of fixation, does not depend only from the sensory stimulation originated in the environment but also from proprioceptive stimulations and corollary discharges produced by the infants' movements and changes in posture. Thus why do eye movements seem not to have the same kind of influence as head movements ? In paired comparison studies the fixation time on a given target appears independent of its positions (left or right) and therefore of the direction of eye movements leading to its fixation. Specialists in oculomotricity offer an explanation to this lack of influence. The corollary discharge and the proprioceptive stimuli originating in the eye muscles seem to offer very little, if any information about the eye displacements, even in adults (Carpenter, 1977).

Head turning in order to orient sensory receptors toward a source of stimulation is a component of several sensori-motor activities already present at birth. These activities present strong similarities in their way of functioning and the peculiarity to wane or even disappear around the end of the

second month to reappear later in the form of real sensori-motor coordinations. Visual pursuit, precocious reaching, orientation to a lateral sound belong to this kind of activities.

During the first weeks the entire organism participates in any activity of the infant. For example the apparition of a peripheral stationary target (like our ball) entails eye movements in the direction of the stimulus, accompanied by head turning, arm extension and a modification of the whole posture. If the target moves slowly and regularly it is followed by the gaze but the amplitude and duration of visual pursuit depend from the infant's possibilities of postural adaptation (Bullinger). If a change in posture cannot follow the object displacement, the infant loses the target. P. Wolff observed that pursuit could be easily inhibited by a change in state and Büllinger that loss of the target was followed by a change in cardiac rhythm. Alegria and Noirot have demonstrated that a lateral auditory stimulation produces in neonates head orientation toward the sound, accompanied by eye movements and asymmetrical mouthing.

A strong interdependency between sensory, motor and postural activities characterizes the exchanges between an infant and his environment during the first weeks of life. The occurrence of sensory stimulation either from the environment or from the organism mobilizes the entire body in a sort of global response.

In our studies we always select parts from this global

response and relate them with some changes that we have carefully introduced in a limited part of the environment. For example we observe that variation in visual fixation time accompany variations in intrinsic properties of a visual target, that variations in the direction of a movement (of eyes, head, arm) follow variations in the position of a stationary target and in the path of movement of a mobile object. And we are lured into concluding that duration of fixation depends only from the properties of what we have defined as the stimulus .

But, with very young infants, we must expect that the occurrence of any change in the environment, or in the organism, which modifies a component (sensory, motor, postural) of their global response will also induce a change in the other components. This appears to be the best interpretation for the results obtained in our study with the striped ball. During the first phase of the experiment the infant looks at the target, turns his head towards it and accomodates his posture accordingly. Initially the duration of visual fixation is determined by the intrinsic properties of the ball. With repeated trials, the situation becomes familiar, the duration of fixation decreases, but also the duration of head and body orientation toward the ball. The global response with its different components (visual, motor, proprioceptive) becomes habituated. In the test phase a large change in position of the ball modifies the situation. The sensorimotor relation between the infant and the ball is thus a novel one and the global response recovers its initial

intensity. This recovery affects all its components, including visual fixation time.

A dissociation between the components of the global sensori-motor reactions observed in newborns and very young infants appears around the end of the second month. In a longitudinal study, Von Hofsten observed that newborns produced extension movements of the arm in the direction of a stationary object, generally associated with looking at it (precocious reaching, or prereaching). Whereas the visual attention given to the object increased, the amount of reaching during looking decreased strongly between 1 and 7 weeks Von Hofstsen interprets these data as the result of a dissociation between looking and reaching, the first effect of this dissociation being a mutual inhibition between two previously associated activities. Over 10 weeks the inhibition disappears and the two now independant components become progressively integrated to constitute the visually controlled voluntary reaching.

A similar dissociation followed by a proper coordination has been found by Büllinger around 10 weeks, between vision and posture in visual pursuit, and by Field and collaborators around 2 months, between looking, listening and head turning toward a lateral sound.

Conclusion.

Human infants are sensitive from birth to some intrinsic properties of objects, they are also sensitive to their position. During the first weeks of life relevant dimensions

of differentiation between objects are relative to global properties of the entire object or pattern. Position is defined by the direction of a displacement : the trajectory followed by a mobile object, the orientation of the infants' body, the direction of a movement like head turning, or arm thrusting. Movements are differentiated by their direction relative to the infant (experiments with looming objects).

During this first period regularities can be observed between changes in the environment and modifications in the infants' behavior, but differention and recognition measured by a specific index, fixation time for example, is relative to changes or non changes in global sensori motor exchanges between the infant and his environment.

It is only when these sensorimotor exchanges become dissociated in their components that the infant will progressively become able to identify and differentiate perceiving and acting, position and intrinsic properties, etc. etc. As a component is isolated and functions independently from the others, it can enter in relation with others to form structured sensorimotor or intermodal coordinations. This conclusion is not original. Mounoud, Büllinger and others work according to the same assumptions in their own theoretical frames.